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(54) Title: METHOD FOR FLUORESCENCE LIFETIME IMAGING MICROSCOPY AND SPECTROSCOPY

(57) Abstract: A method and system for analysis of fluorescence emission spectroscopy data and fluorescence lifetime imaging microscopy data are described. A unique Laguerre expansion can be found for fluorescence intensity decays of arbitrary form with convergence to a correct solution faster than with conventional methods. The Laguerre expansion technique includes expansion coefficients highly correlated with intrinsic fluorescence lifetimes, allowing direct characterization of fluorescence dynamics. For complex systems, conventional analysis of fluorescence intensity decay in terms of discrete exponential components can not readily provide a true representation of underlying fluorescence dynamics. Utilizing the Laguerre expansion technique, an alternative non-parametric method for analysis of time-resolved fluorescence data from various systems is described, facilitating characterization and discrimination of a sample. An ultra-fast method for analysis of fluorescence lifetime imaging is also described, facilitating real-time analysis of compositional and functional changes in samples, at a microscopic or macroscopic level.